Delivery of Time-Enabled WMS via KML

Karl Benedict
Director, Earth Data Analysis Center
University of New Mexico
kbene@edac.unm.edu

ESDSWG Annual Meeting - Philadelphia, PA. October 21-23, 2008

Overview

- Relevant standards
- Time-enabled WMS request model
- KML GroundOverlay
- Integration of time-enabled WMS in KML
- Deployment into Google Earth
- Implementation issues
- Conclusions

Relevant Standards

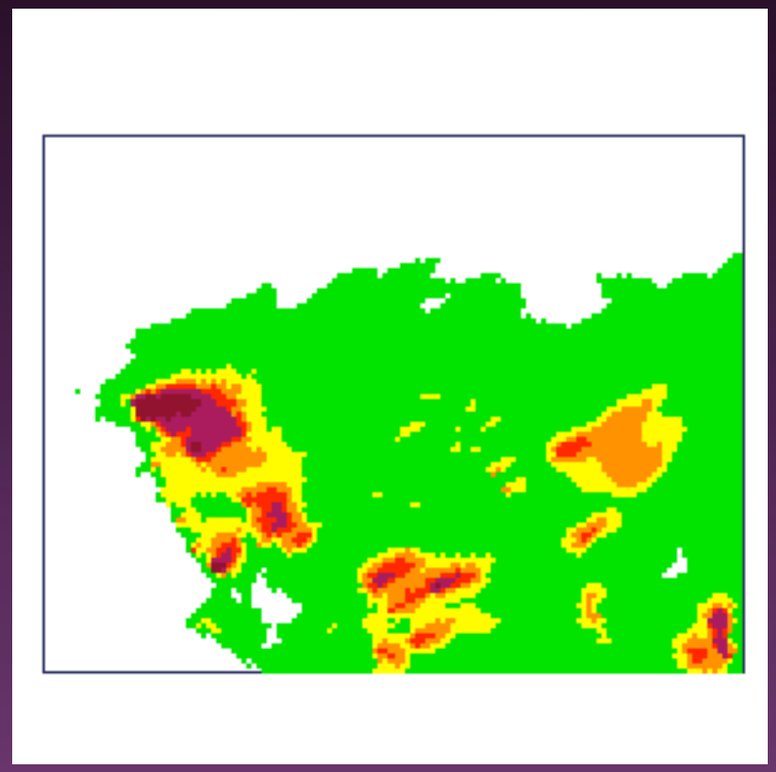
- OGC Web Map Services (WMS)
  - *Service interface developed for the delivery of map images*
  - Basic WMS standard defines *GetCapabilities*, *GetMap* requests
  - Time-enabled WMS services support an optional *time* parameter as part of the request
- OGC KML
  - *Standard focused (*not exclusively*) on geographic visualization, including annotation of maps and images*
  - Includes support for integration of WMS service calls through its *GroundOverlay* capability

Time-Enabled WMS Request Model

- Basic WMS GetMap Request

```
http://edacwms.unm.edu/cgi-bin/mapfiles/
imagery_wms?
WMTVER=1.1.1&SERVICE=WMS&REQUEST=GetMap&SRS
=EPSG:4326&FORMAT=image/
jpeg&STYLES=&LAYERS=modis_nm&TRANSPARENT=TR
UE&WIDTH=300&HEIGHT=300&bbox=-110.6387,35.0
,-107.2387,38.4
```

Time-Enabled WMS Request Model

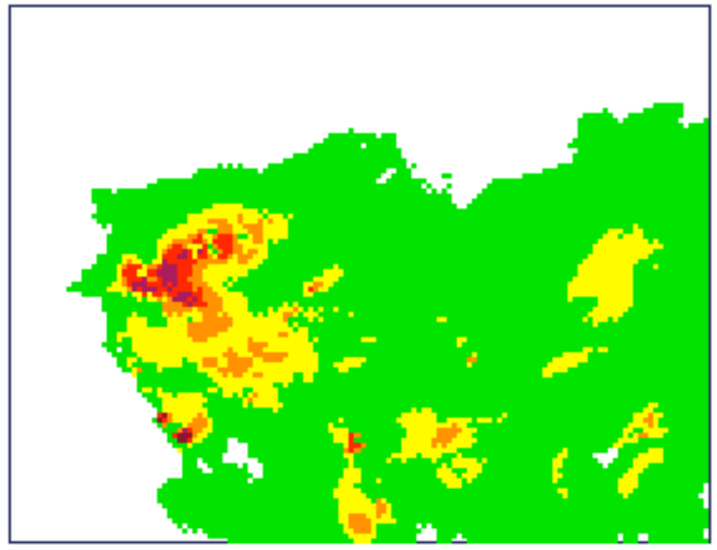


- Time Enabled WMS GetMap Request

```
http://phairs-devel.unm.edu/cgi-bin/
mapserv_5.0.0&map=mapmodule_wms.map&SERVICE
=WMS&VERSION=1.1.1&REQUEST=GetMap&TRANSPARE
NT=TRUE&STYLES=&FORMAT=image/png&SRS=EPSG:
4326&Width=300&Height=300&Layers=model_doma
in,dream_pm10_classed&BBOX=-121,23,-96,48&
```

Time-Enabled WMS Request Model

TIME=2008-01-07T06:00:00Z



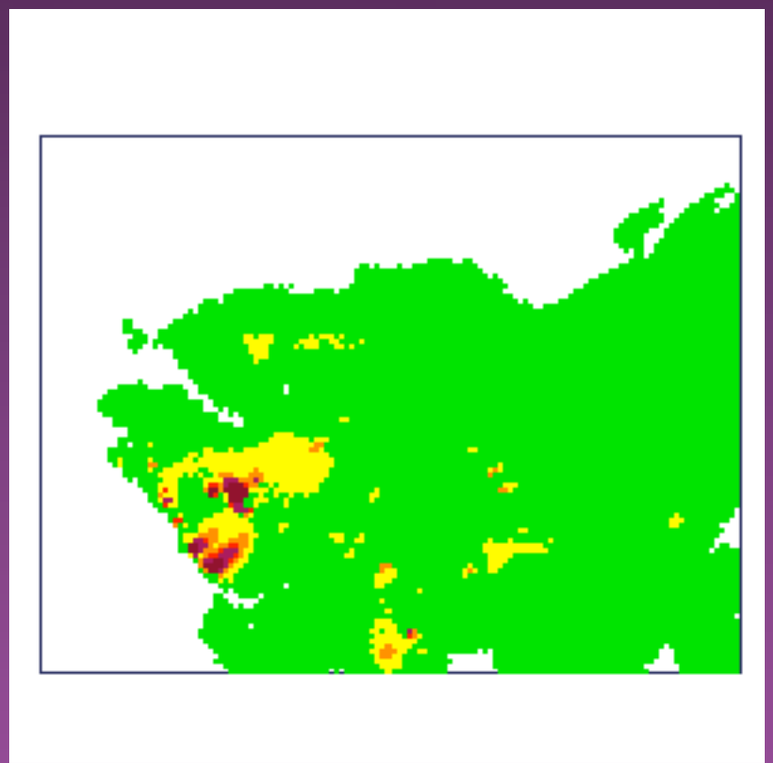
- Time Enabled WMS GetMap Request

```
http://phairs-devel.unm.edu/cgi-bin/
mapserv_5.0.0&map=mapmodule_wms.map&SERVICE
=WMS&VERSION=1.1.1&REQUEST=GetMap&TRANSPARE
NT=TRUE&STYLES=&FORMAT=image/png&SRS=EPSG:
4326&Width=300&Height=300&Layers=model_doma
in,dream_pm10_classed&BBOX=-121,23,-96,48&
```

Time-Enabled WMS Request Model

- Time Enabled WMS GetMap Request

```
http://phairs-devel.unm.edu/cgi-bin/
mapserv_5.0.0&map=mapmodule_wms.map&SERVICE
=WMS&VERSION=1.1.1&REQUEST=GetMap&TRANSPARE
NT=TRUE&STYLES=&FORMAT=image/png&SRS=EPSG:
4326&Width=300&Height=300&Layers=model_doma
in,dream_pm10_classed&BBOX=-121,23,-96,48&
TIME=2008-01-07T12:00:00Z
```

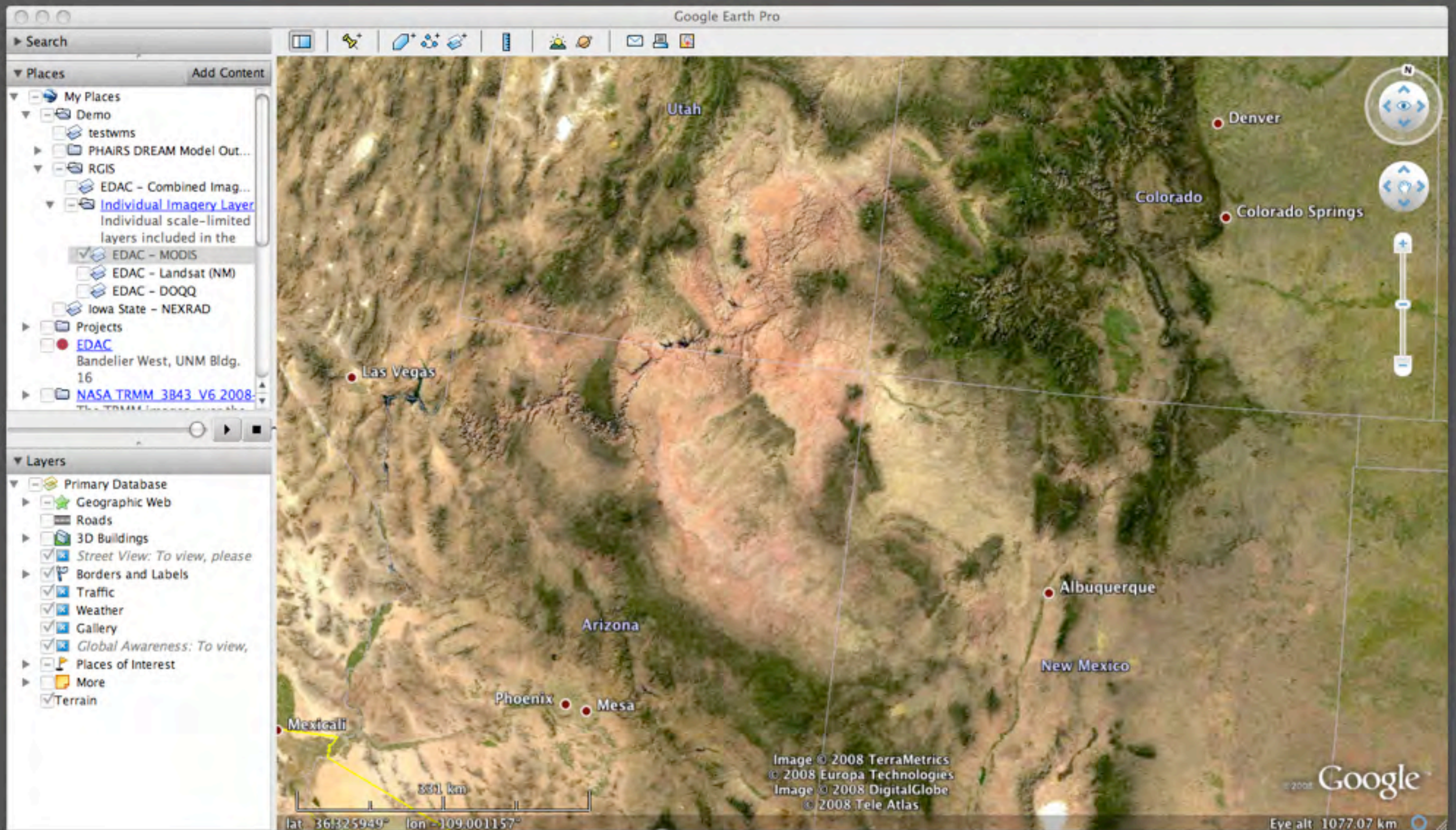


KML GroundOverlay

- Basic WMS Layer

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://www.opengis.net/kml/2.2">
<GroundOverlay>
      <name>EDAC - DOQQ</name>
      <visibility>0</visibility>
      <open>1</open>
      <Icon>
         <href>http://edacwms.unm.edu/cgi-bin/mapfiles/imagery_wms?
         VERSION=1.1.1&amp;REQUEST=GetMap&amp;SRS=EPSG:
         4326&amp;LAYERS=doqq05,doqq06_gaps,doqq06&amp;TRANSPARENT=TRUE&amp;FORMAT=i
         mage/jpeg&amp;STYLES=&amp;WIDTH=1024&amp;HEIGHT=1024&amp;</href>
         <viewRefreshMode>onStop</viewRefreshMode>
      </Icon>
      <LatLonBox>
         <north>45.29291497303174</north>
         <south>22.35233061474838</south>
         <east>-86.27820185334545</east>
         <west>-130.721796390938</west>
      </LatLonBox>
</GroundOverlay>
</kml>
```

Basic *GroundOverlay* in Google Earth



Integration of Time-enabled WMS in KML

- Addition of temporal element into the *GroundOverlay* element
  - kml:*TimeSpan*

```
<TimeSpan>
    <begin>2008-01-07</begin>
    <end>2008-01-07T00:59:59Z</end>
</TimeSpan>
```

  - kml:*TimeStamp*

```
<TimeStamp>
    <when>2008-01-07</when>
</TimeStamp>
```

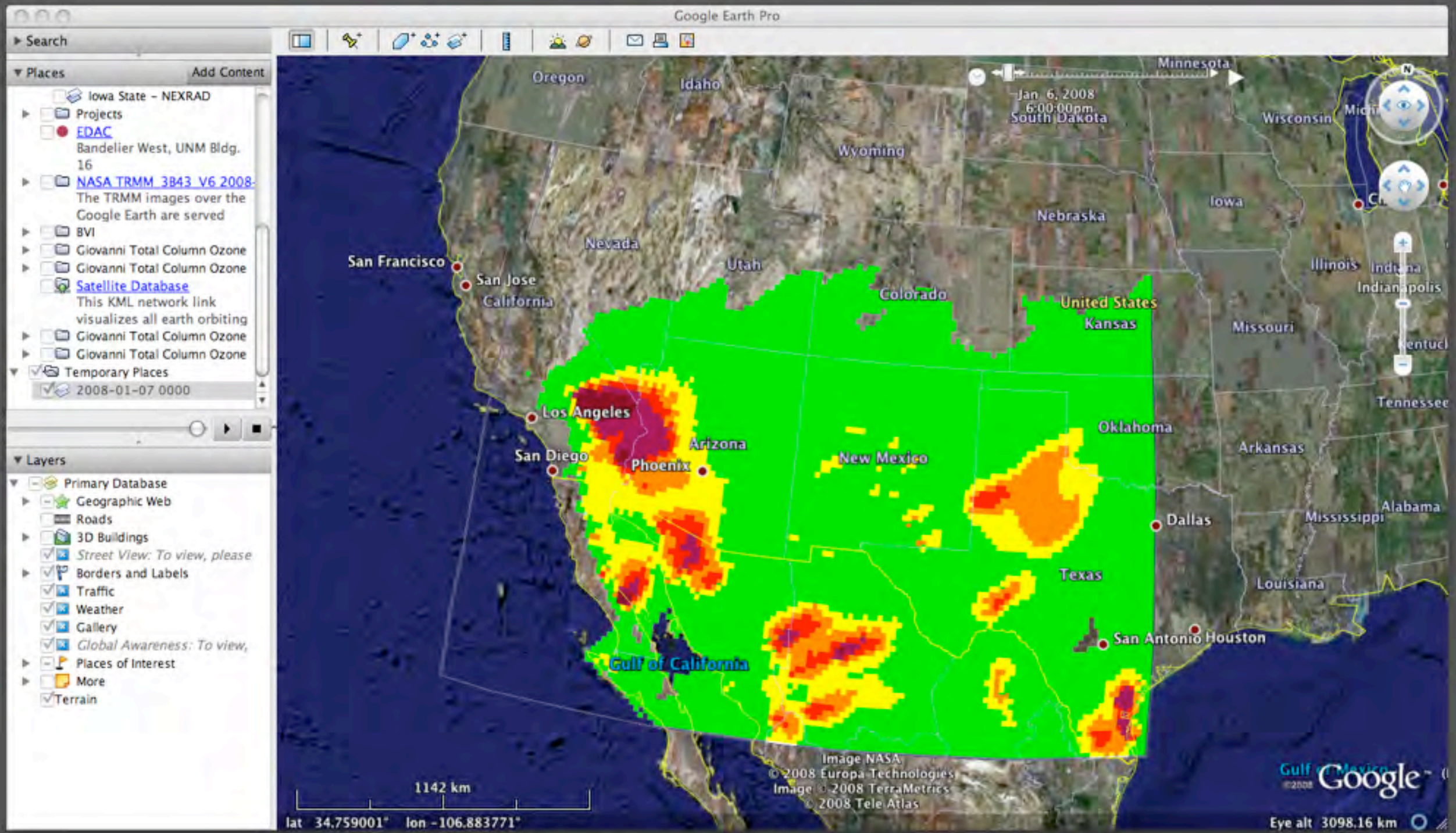
Time-Enabled *GroundOverlay*

- Time-enabled WMS Layer

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://www.opengis.net/kml/2.2">
 <GroundOverlay>
      <name>2008-01-07 0000</name>
      <visibility>0</visibility>
          <TimeSpan>
           <begin>2008-01-07</begin>
           <end>2008-01-07T00:59:59Z</end>
      </TimeSpan>
      <Icon>
              <href>http://phairs-devel.unm.edu/cgi-bin/mapserv_5.0.0?
              map=mapmodule_wms.map&amp;SERVICE=WMS&amp;VERSION=1.1.1&amp;REQUEST=Get
              Map&amp;TRANSPARENT=TRUE&amp;STYLES=&amp;FORMAT=image/png&amp;SRS=EPSG:
              4326&amp;Width=1000&amp;Height=1000&amp;Layers=model_domain,dream_pm10_
              classed&amp;TIME=2008-01-07T00:00:00Z&amp;</href>
           <viewRefreshMode>onStop</viewRefreshMode>
      </Icon>
      <LatLonBox>
           <north>90</north>
           <south>-27.74775167156848</south>
           <east>180</east>
           <west>-180</west>
      </LatLonBox>
 </GroundOverlay>
</kml>
```

- Why use *TimeSpan* instead of *TimeStamp*?

Time-Enabled *GroundOverlay* in Google Earth

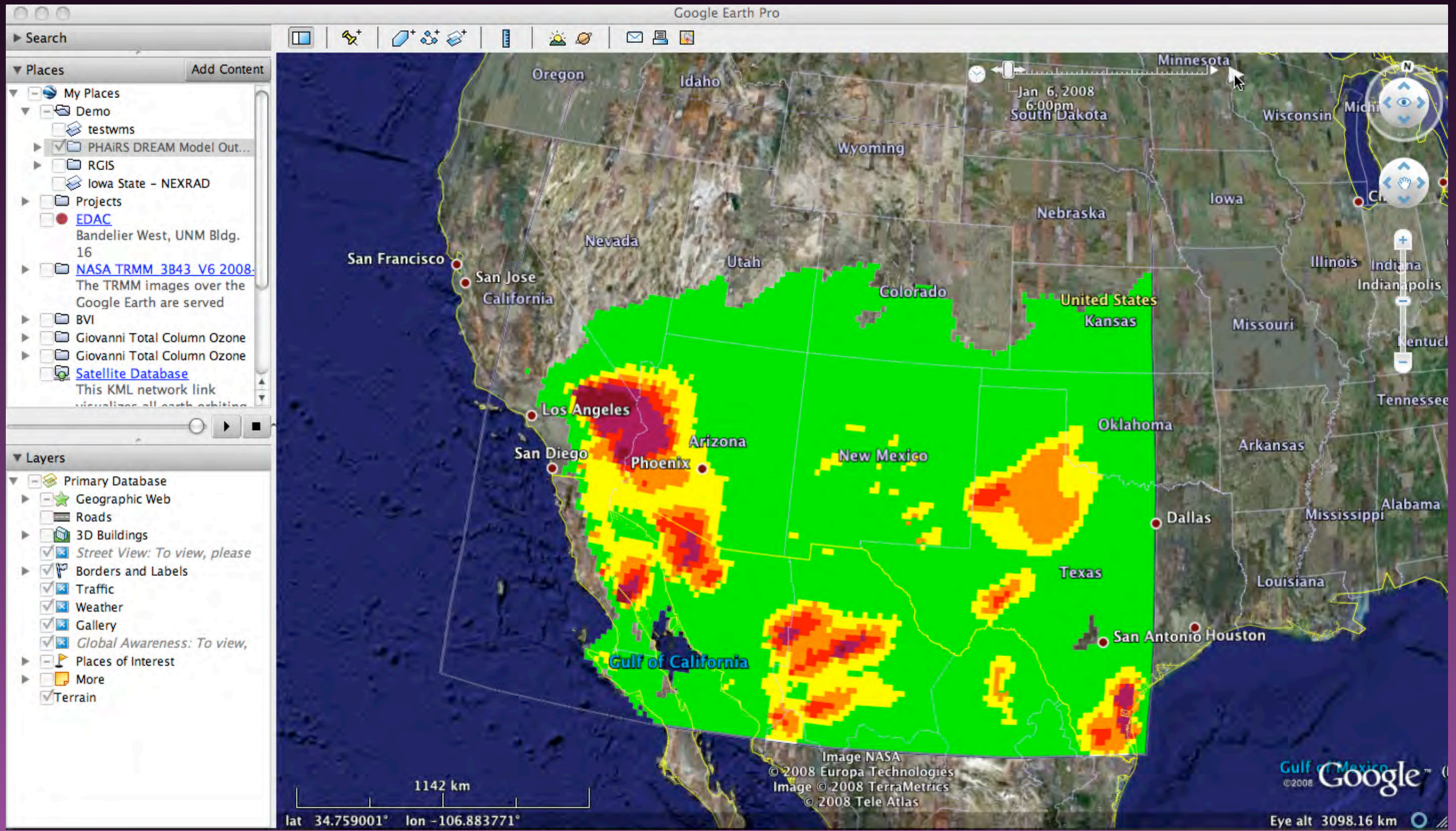


Multiple Time-Enabled WMS Requests in KML

- Multiple *GroundOverlay* elements within a *Folder*

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://www.opengis.net/kml/2.2">
<Folder>
 <name>PHAiRS DREAM Model Outputs - PM10</name>
 <visibility>0</visibility>
 <GroundOverlay> ... </GroundOverlay>
 <GroundOverlay> ... </GroundOverlay>
      ...
 <GroundOverlay> ... </GroundOverlay>
</Folder>
</kml>
```

Multiple Time-Enabled WMS Requests in Google Earth



Implementation Issues

- The current time specification model requires explicit *GroundOverlay* elements for each time step
  - ✓Include a WMS-style time-range and interval specification for repeating time sequences
  - ✓Add a *datetime* query parameter that can be appended to the kml:href request (used as part of the *GroundOverlay* element). This would complement the bounding box parameters that are available within the specification.
- The current specification allows for implicit temporal resolution for time elements to date
  - ✓Extend the implicit time resolution specification to a higher resolution - from date to at least hour

Conclusions

- Time-enabled WMS has proven to be a very powerful model for the efficient delivery of map images from large collections of model outputs (e.g. over 52k output rasters/particle size for DREAM Dust model outputs)
- KML's WMS and time support has streamlined the delivery of collections of model outputs into clients that implement the standards.
- The implementation of time-enabled WMS within a specific application has highlighted areas where the KML specification can be extended to better support the delivery of time-enabled content

Resources

- de la Beaujardiere, J. (Ed.). (2006). OpenGIS Web Map Server Implementation Specification, Version 1.3.0 (Vol. OGC® 06-042): Open Geospatial Consortium. *http://www.opengeospatial.org/standards/wms*
- Wilson, T. (Ed.). (2008). OGC® KML, Version 2.2.0 (Vol. OGC 07-147r2): Open Geospatial Consortium. *http://www.opengeospatial.org/standards/kml*